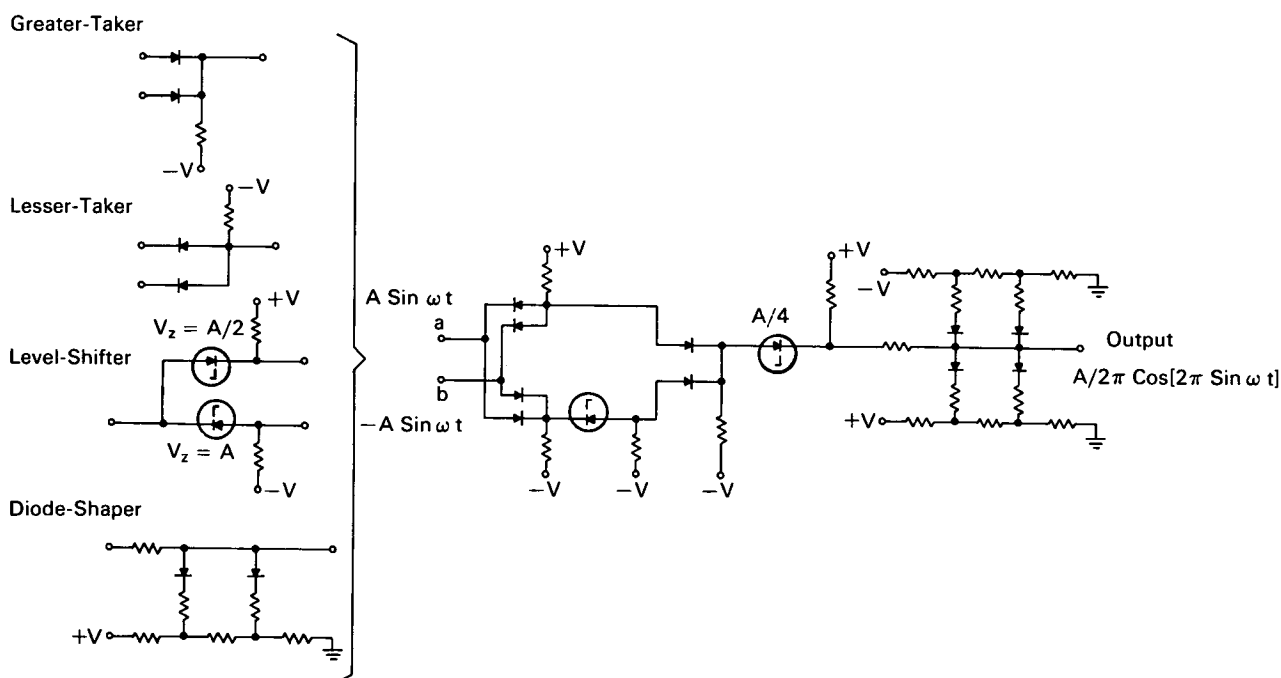


# NASA TECH BRIEF



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## Function Generator Eliminates Necessity of Series Summation



### The problem:

To produce complex waveforms electronically without the necessity of series summation.

### The solution:

A diode generator that produces functions of such complexity as  $\sin(2\pi \sin \omega t)$  and  $\cos(2\pi \sin \omega t)$  at frequencies down to zero cycles per second, using the combined outputs of four basic circuits.

### How it's done:

This generator uses four building-block circuits to produce complex waveforms without the necessity of mathematically reducing the desired function to a

series, and then summing the outputs produced by circuits generating the waveforms represented by the individual series elements.

Each of the four circuits alters the input signals in a particular way. One takes the greater part of both input signals (greater-taker), one takes the lesser part of both signals (lesser-taker), one splits the positive input into a positive and negative signal of the same waveshape (level-shifter), and one rounds off the top of the positive input (diode-shaper). For example, in the circuit diagram shown for the development of the function of  $\cos(2\pi \sin \omega t)$ , the circuits are

(continued overleaf)

so connected that the characteristic input waveshapes of  $Asin\omega t$  at point a and  $-Asin\omega t$  at point b are modified sequentially by each circuit to result in an output waveform that very closely approximates the desired function.

The four basic circuits can be connected in various ways to produce the same waveform. They are sufficiently flexible that some resistors can be eliminated, some diodes can be replaced by emitter-follower transistor configurations, and the number of components in the diode-shaper can be varied, depending on the particular application of the generator. There are also combinations of circuits in which the forward voltage drops of the greater- and lesser-taker diodes are compensated by using two diodes where functionally only one is required.

**Notes:**

1. This highly specialized method of producing complex waveforms requires less power than present methods and uses simpler circuitry.

2. Many functions other than those indicated here can be implemented by an empirical synthesis of the same building-block circuits.
3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Goddard Space Flight Center  
Greenbelt, Maryland 20771  
Reference: B66-10351

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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